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GB 2173274 A GB 1242694 A US 4601287 A
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(54) Heater for a component of a breathing gas circuit

(57) A filter or heat and moisture exchange device (HME) has a housing with a separate heater 5 retained on the housing by a coupling 42 engaging a flange 52 on the heater. The heater has a helical wire heating element 54 and a layer of insulating material 57 on an outside surface and warms the internal surface of the wall of the housing to reduce condensation.

Fig.1

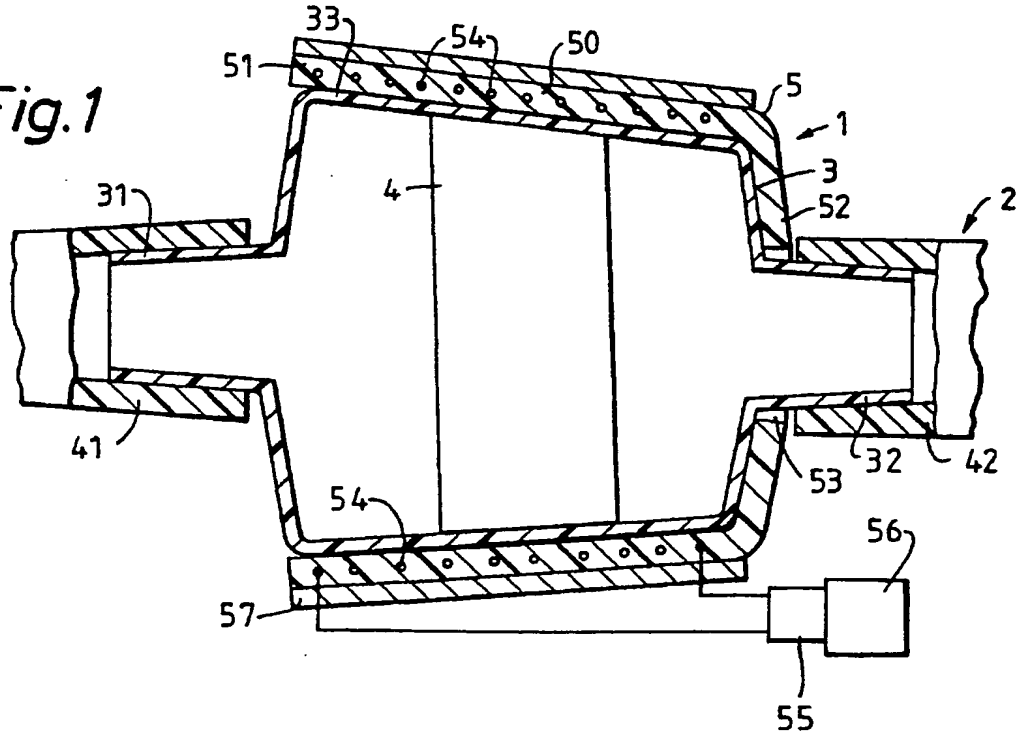

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Fig.1

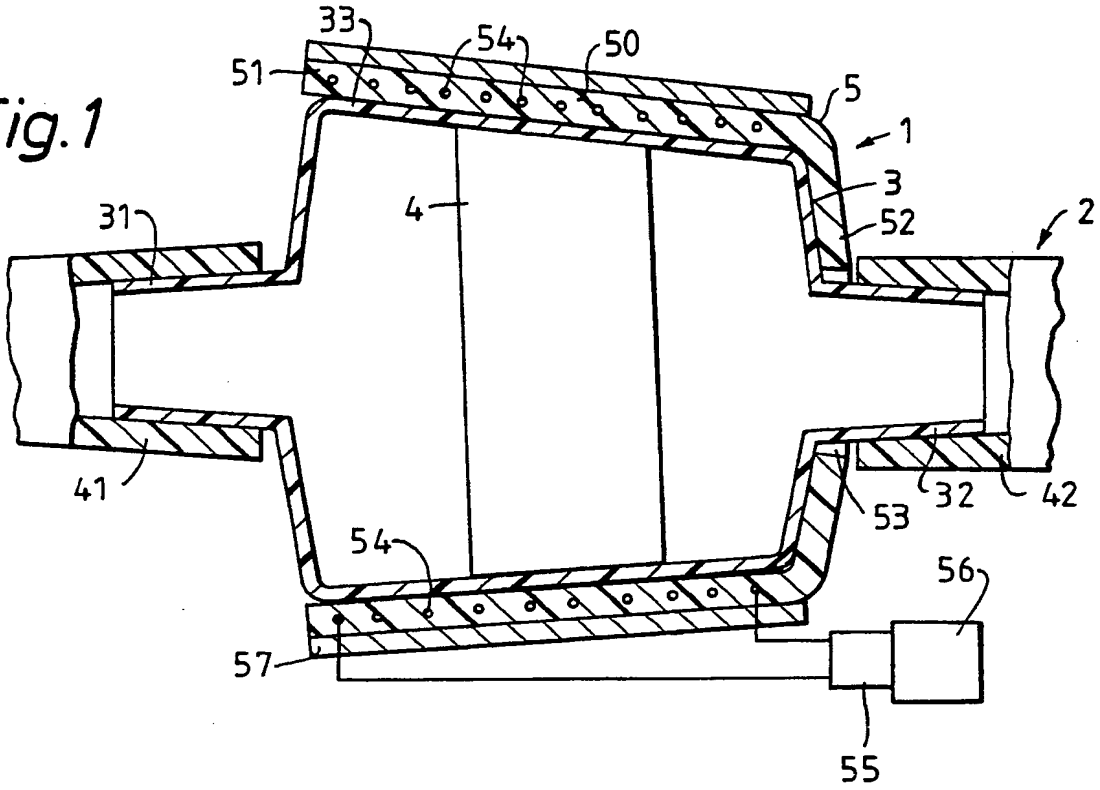
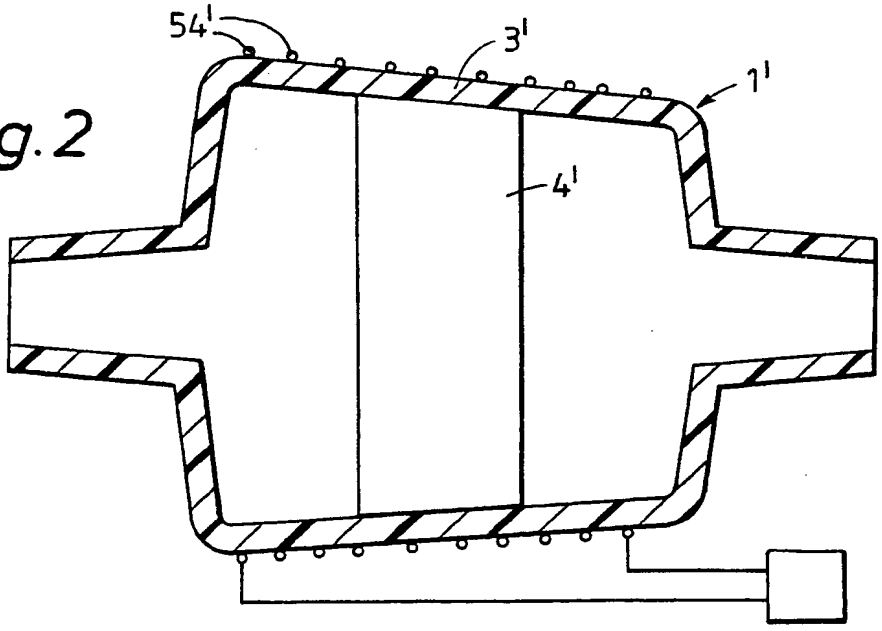


Fig.2



HEATERS AND HEATED DEVICES

This invention relates to heaters and heated devices.

The invention is more particularly concerned with heaters for medico-surgical devices such as filters or heat and moisture exchange devices.

Patient breathing circuits can include heat and moisture exchange devices (HMEs). These HMEs include an element of foam or treated paper through which passes both the inhaled and exhaled gas from the patient. The exhaled gas gives up a part of its heat and moisture to the exchange element, which is then transferred to inhaled gas when the patient inhales. In this way, the gas supplied to the patient is heated and moistened reducing the risk that the patient will have a sore throat following surgery. An example of an HME is described in GB 2233904. One problem with HMEs is that condensation in the housing can lead to a build-up of water. When the problem is severe it can require the use of a hydrophobic membrane to prevent the transmission of liquid to the patient. It is undesirable to use such a membrane because it impedes gas flow through the device. To overcome this resistance to gas flow it is necessary to increase the size of the device, making it more cumbersome, heavier and more expensive. Similar problems of condensation exist in bacterial filters and the like.

One way of reducing the build up of water is to include a heater within the device. In WO 91/19527 there is described an HME including a heater located adjacent the exchange element. This reduces condensation and also improves the performance of the HME by increasing the temperature and humidity of the inhaled gas. Because, however, the heater is located centrally, it has a relatively low effect on heating the wall of the housing, which is the main area of cool surface on which condensation occurs.

It is an object of the present invention to provide an improved heater or an improved heated device.

According to one aspect of the present invention there is provided a heater for a device through which gas flows in a breathing gas circuit, the heater comprising an electrical resistance heating element having a surface adapted to be in thermal contact with a wall of the device such that the internal surface of the wall of the device can be heated to reduce condensation within the device.

The heater is preferably separable from the device and is adapted to contact the external surface of the wall of the device. The device and the heater may be of frusto-conical shape. The heater may have an inwardly-extending flange at one end with a central aperture, the device having a male coupling that projects through the aperture and the heater being retained on the device by means of a cooperating female coupling. The heater may include a layer of insulating material on an outside surface.

Alternatively, the heater element may be incorporated in the wall of the device.

The heating element may be a helical wire. The device may be a filter or a heat and moisture exchange device.

According to another aspect of the present invention there is provided an assembly including a device through which gas flows in a breathing circuit and a heater according to the above one aspect of the present invention.

According to a further aspect of the present invention there is provided a filter for breathing circuit, the filter including a housing having an inlet and outlet coupling and a filter element, and the wall of the housing including an electrical resistance heating element such that the wall of the housing can be heated to reduce condensation within the device.

According to yet another aspect of the present invention there is provided a heat and moisture exchange device for a breathing circuit, the device including a housing having an inlet and outlet coupling and a heat and moisture exchange element, the wall of the housing including an electrical resistance heating element such that the wall of the housing can be heated to reduce condensation within the device.

A patient breathing assembly including a filter device and a heater in accordance with the present invention will now be described, by way of example, with reference to the accompanying drawing, in which:

Figure 1 is a partly sectional side elevation of the assembly; and

Figure 2 is a side elevation of a part of an alternative assembly.

The assembly includes a filter device 1 and a patient breathing circuit, indicated generally by the numeral 2, in which the filter is connected. The device 1 has a outer housing 3 containing a conventional bacterial filter element 4 through which passes gas flowing along the breathing circuit.

The housing 3 is of a transparent plastics material such as polycarbonate and is of circular section. Two male luer taper couplings 31 and 32 are formed at opposite ends of the housing 3; these connect to female couplings 41 and 42 in the breathing circuit. The central region 33 of the housing is enlarged in diameter, compared with the couplings, and has a slight taper so that it is of frusto-conical shape.

The assembly is completed by a heater 5 closely embracing the central region 33 of the housing. The heater 5 is in the form of a frusto-conical shell 50 open at its larger, left-hand end 51 and having an inwardly-extending flange 52 lying against the right-hand side of the central region 33 of the housing. A central aperture 53 in the flange 52 is large enough to receive the right-hand luer coupling 32. The shell 50 is a close, slip fit onto the outside of the housing 3 so as to ensure a close thermal contact between the heater 5 and the housing. The heater 5 is retained on the filter device 1 by contact of the flange 52 with the female coupling 42 on the breathing circuit. The shell 50 is of a heat-resistant plastics material and includes an electrical resistance heating element 54 such as a fine metal wire extending helically around the shell. The heating element 54 may be on the inside or outside of the shell, or, as shown, incorporated within the thickness of the shell. A cable 55 connects the heating element 54 to a remote source 56 of low-power electricity, such as a battery. On the outside of the heater 5 there is a layer 57 of soft insulating material. This serves to maintain heat within the device and also provides a comfortable surface if the heater should come into contact with the patient's skin.

The heater 5 can be removed from the filter device 1 and reused on another device. It does not come into direct contact with gas flowing along the breathing circuit so it is not a source of contamination.

In operation, the entire interior heating surface of the heater 5 is in contact with the wall of the housing 3 of the filter device 1. The heat will be conducted through the wall of the housing to warm the inside surface. This, therefore, greatly reduces the area of cold surface in the device on which condensation can occur and, thereby, reduces the formation of liquid water. Because there is little risk of water entering the patient breathing system from the filter device, there is no need to employ a hydrophobic membrane. This avoids the need to increase the size of the device in order to compensate for the resistance to gas flow caused by such a membrane.

Instead of a filter element, the device could include a conventional heat and moisture exchange element. The heater is particularly advantageous in such applications because the increased temperature improves the performance of the HME.

It is not essential for the heater to be separate and removable. It could be incorporated into the filter or HME device in the manner shown in Figure 2. In this arrangement the heater is an electrical resistance wire 54' wrapped around the housing 3'. The wire 54' may be secured to the housing using an adhesive or be moulded into the wall of the housing. With such a device, the heater would be disposed of with the device itself.

Various other forms of heating element are possible. For example, a heating tape or thin-film could be used. The heater may include a positive temperature coefficient resistance so that the temperature of the heater is self regulating. The heater could extend over the couplings at opposite ends of the device to reduce condensation in this area.

CLAIMS

1. A heater for a device through which gas flows in a breathing gas circuit, wherein the heater comprises an electrical resistance heating element having a surface adapted to be in thermal contact with a wall of the device such that the internal surface of the wall of the device can be heated to reduce condensation within the device.

2. A heater according to Claim 1, wherein the heater is separable from the device and is adapted to contact the external surface of the wall of the device.

3. A heater according to Claim 2, wherein the device and the heater are of frusto-conical shape.

4. A heater according to Claim 2 or 3, wherein the heater has an inwardly-extending flange at one end with a central aperture, wherein the device has a male coupling that projects through the aperture, and wherein the heater is retained on the device by means of a cooperating female coupling.

5. A heater according to any one of the preceding claims, wherein the heater includes a layer of an insulating material on an outside surface.

6. A heater according to Claim 1, wherein the heating element is incorporated in the wall of the device.

7. A heater according to any one of the preceding claims, wherein the heating element is a helical wire.

8. A heater according to any one of the preceding claims, wherein the device is a filter.

9. A heater according to any one of Claims 1 to 7, wherein the device is a heat and moisture exchange device.

10. A heater substantially as hereinbefore described with reference to Figure 1 of the accompanying drawings.

11. A heater substantially as hereinbefore described with reference to Figure 1 as modified by Figure 2 of the accompanying drawings.

12. An assembly including a device through which gas flows in a breathing circuit and a heater according to any one of the preceding claims.

13. A filter for a breathing circuit, the filter including a housing having an inlet and output coupling and a filter element, wherein the wall of the housing includes an electrical resistance heating element such that the wall of the housing can be heated to reduce condensation within the device.

14. A heat and moisture exchange device for a breathing circuit, the device including a housing having an inlet and outlet coupling and a heat and moisture exchange element, wherein the wall of the housing includes an electrical resistance heating element such that the wall of the housing can be heated to reduce condensation within the device.

15. A filter for a breathing circuit substantially as hereinbefore described with reference to Figure 1 of the accompanying drawings.

16. A filter for a breathing circuit substantially as hereinbefore described with reference to Figure 1 as modified by Figure 2 of the accompanying drawings.

17. Any novel feature or combination of features as hereinbefore described.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report) -9-	Application number GB 9406963.0
Relevant Technical Fields (i) UK Cl (Ed.M) A5T (TDB, TDF, TDP) (ii) Int Cl (Ed.5) A61M 16/00, 16/10, A62B 7/10, 9/00, 23/00	Search Examiner L V THOMAS Date of completion of Search 15 JULY 1994
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE DATABASE: WPI	Documents considered relevant following a search in respect of Claims :- 1-16

Categories of documents

X:	Document indicating lack of novelty or of inventive step.	**P:**	Document published on or after the declared priority date but before the filing date of the present application.
Y:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	**E:**	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	**&:**	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2173274 A	(BOC) see whole document	1, 5, 7, 12
X	GB 1242694	(FISHER & PAYKEL) see line 91 page 4 - line 65 page 5	1, 6, 7, 9
X	US 4601287	(ROYCE JR) see line 35 column 4 - line 18 column 5	1, 8, 13
X	WPI Abstract Acc. No 73-62299U/42 and FR 2165269 A (RHONE-POULENC)		1,6,12

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).